

GEO-CAPE Oceans STM

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Science Focus	Science Questions	Maps to Science Question	Measurement Requirements	Instrument Requirements	Platform Requirem.	Ancillary Data Requirem
	How do short-term coastal and open ocean processes interact with and influence larger scale physical, biogeochemical and ecosystem dynamics? (OBB 1)	deco-cape will observe coastal regions at sufficient temporal and spatial scales to resolve near-shore processes, tides, coastal fronts, and eddies, and track carbon pools and pollutants. Two complementary operational modes will be employed: (1) survey mode for evaluation of diurnal to interannual variability of constituents, rate measurements and hazards for estuarine and continental shelf and along regions with linkages to 3.	the near-UV, visible & NIR for separating absorbing & scattering constituents & chlorophyll fluorescence Product uncertainty TBD	Spectral Range: Hyperspectral UV-VIS-NIR • Threshold: 345-1050 nm; 2 SWIR bands 1245 & 1640 nm • Baseline: 340-1100 nm; 3 SWIR bands 1245, 1640, 2135 nm •Spectral Sampling & Resolution: • Threshold: UV-Vis-NIR: ≤2 & ≤5nm	Geostationary orbit Threshold: 94°±2° W longitude; Baseline: 94°±1° W to permit sub- hourly observations of coastal waters adjacent to the continental U.S.,	Western hemisphere data sets from models missions, or field observations Measurement Requirements (1) Ozone (2) Total water
Land- Ocean Exchange	How are variations in exchanges across the land- ocean interface related to changes within the watershed, and how do such exchanges influence coastal and open ocean biogeochemistry and ecosystem dynamics? (OBB 1 & 2; CCSP 1 & 3)	continental shelf and slope regions with linkages to open-ocean processes at appropriate spatial scales, and (2) targeted, high-frequency sampling for observing episodic events including evaluating the effects of diurnal variability on upper ocean constituents, assessing the rates of biological processes and coastal hazards. Measurement objectives for both modes include: (a) Quantify dissolved and particulate carbon pools and related rate measurements such as export production, air-sea CO2 exchange, net community production, respiration, and photochemical oxidation of dissolved organic matter.	Targeted Events: • Threshold: ≤1 hour • Baseline: ≤0.5 hour Survey Coastal U.S.:	400-450nm: ≤0.4 & ≤0.8nm (for NO ₂ at spatial resolution of 750x750m at nadir); SWIR resolution: ≤20-40 nm • Baseline: UV-ViS-NIR: ≤0.25 & 0.7 nm; SWIR: ≤20-50 nm Signal-to-Noise Ratio (SNR) at Lty • Threshold: ≥1000 for 10 nm FWH ≥600 for 40 nm FWHM (800-900 nm FWHM (900-1050 nm); ≥250 and ≥4 1640 nm (20 & 40 nm FWHM); ≥500	South America Storage (up to 1 day) and download of full spatial data and spectral data. (p(70° SZA): M (350-800 nm); 1); ≥300 for 40 nm 80 for 1245 & 1) NO₂ band.	vapor (3) Surface wind velocity (4) Surface barometric pressure (5) Vicarious calibration & validation - coastal (6) Full prelauncl characterization (7) Cloud cover
Climate Change & Human Activity	How are the productivity and biodiversity of coastal ecosystems changing, and how do these changes relate to natural and anthropogenic forcing, including local to regional impacts of climate variability? (OBB 1, 2 & 3; CCSP 1 & 3)	(b) Quantify phytoplankton properties: biomass, pigments, functional groups (size/taxonomy/Harmful Algal Blooms (HABs)), daily primary productivity using bio-optical models, vertical migration, and chlorophyll fluorescence. (c) Measure the inherent optical properties of coastal ecosystems: absorption and scattering of particles phytoplankton and detritus, CDOM absorption. (d) Estimate upper ocean particle characteristics including particle abundance and particle size distribution.	Other coastal and large inland bodies of water within ocean color FOR: • Baseline: ≤3 hours Spatial Resol. (nadir): • Threshold: ≤375 x 375 m • Baseline: ≤250 x 250 m Field of Regard for Ocean Color Retrievals: 60°N to 60°S; 155°W to 35°W	 Baseline: ≥1500 for 10 nm (350-86 SWIR and NO₂ bands same as thre the 2135nm (50nm FWHM) Threshold: Aggregate SWIR band pixels to meet SNR; Baseline: No a Scanning area per unit time: Thre km²/min; Baseline: ≥50,000 km²/mi Field of Regard: Full disk: 20.8° E-W and 19° N-S capability from nadir for Lunar & Sol Error (as % of nadir pixel) 	Science Requirements (1) SST (2) SSH (3) PAR (4) UV solar irradiance (5) MLD° (6) Air/Sea pCO2 (7) pH (8) Ocean circulation (9) Tidal & other coastal currents	
A inhance	How do airbornederived fluxes from precipitation, fog and	(e) Detect, quantify and track hazards including HABs and petroleum-derived hydrocarbons.	Coastal Coverage*: width from coast to ocean: Threshold: min 375 km Baseline: min 500 km	Pointing Knowledge <50 Pointing Accuracy LOS <10 Pointing Stability LOS <25 Geolocation Reconstr. <50	0% <10% 0% <25% 5% <10%	(10) Aerosol deposition (11) run-off loading in coasta zone (12) Wet
Derived Fluxes	episodic events such as fires, dust storms & volcanoes affect the ecology and biogeochemistry of coastal and open ocean ecosystems? (OBB 1 & 2; CCSP 1)	(1) to derive coastal carbon budgets and determine whether coastal ecosystems are sources or sinks of carbon to the atmosphere, (2) to quantify the responses of coastal ecosystems and biogeochemical cycles to river discharge, land use change, airborne-derived fluxes, hazards and climate change, and 1 2 3 4 5	Scanning Priority: •Threshold: 1. Survey of U.S. Coastal Waters 2. Other coastal and large inland bodies of water 3. Open ocean waters within FOR	Non-saturating detector array(s) a On-board Calibration: • Lunar: Threshold: minimum mont Baseline: same as threshold • Solar: Threshold: none; Baseline Polarization Sensitivity: <1.0% Relative Radiometric Precision: • Threshold: ≤1% through mission I	deposition in coastal zone (13) Wave height & surface wind speed Validation Requirements Conduct high frequency field measurements	
Episodic Events & Hazards	How do episodic hazards, contaminant loadings, and alterations of habitats impact the biology and ecology of the coastal zone? (OBB 4)	(3) to enhance management decisions with improved information on the coastal ocean, such as required for Integrated Ecosystem Assessment (IEA), protection of water quality, and mitigation of harmful algal blooms, oxygen minimum zones, and ocean acidification.	download from other sensor making.	• Baseline: ≤0.5% through mission Mission lifetime: Threshold: 3 year Baseline only: Near Real-Time sates (GOES, etc.) for on-board autonomen: Adequate to achieve the required	and modeling to validate GEO-CAPE retrievals from river mouths to beyond the edge of the continental margin.	

GEO-CAPE Science Questions are traceable to NASA's OBB Advanced Planning Document (OBB) and the U.S. Carbon Cycle Science Plan (CCSP).

^{*} Coastal coverage within field-of-view (FOV) includes major estuaries and rivers such as Chesapeake Bay, Lake Pontchartrain/Mississippi River delta and the Laurentian Great Lakes, e.g., the Chesapeake Bay coverage region would span west to east from Washington D.C. to several hundred kilometers offshore (total width of 375 km threshold).